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Posttraumatic stress symptoms and smoking to reduce negative affect: An investigation of trauma-exposed daily smokers

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Abstract

The present investigation examined the relations among posttraumatic stress symptoms and smoking motives. Participants included 100 daily smokers recruited from the community and university settings who reported exposure to at least one traumatic event that met criterion A for posttraumatic stress disorder. Consistent with prediction, higher levels of posttraumatic stress symptoms were associated with smoking to reduce negative affect; this relation was observed after controlling for variance accounted for by number of cigarettes smoked per day and gender. Results are discussed in terms of the implications of smoking to regulate affect among daily smokers who have been exposed to traumatic events.

Keywords: Smoking; Posttraumatic stress; Comorbidity; Affect regulation; Smoking motives

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1. Introduction

Past research has demonstrated that exposure to traumatic events is associated with increased smoking behavior (Weaver & Etzel, 2003). For example, compared to persons without trauma exposure, higher rates of smoking have been found among individuals exposed to various trauma types, including interpersonal violence (Acierno, Kilpatrick, Resnick, Saunders, & Best, 1996; Weaver & Etzel, 2003), combat exposure (Beckham et al., 1995; Shalev, Bleich, & Ursano, 1990), and witnessing violence (Acierno et al., 1996). These data highlight the importance of better understanding the nature of the smoking–trauma association.

An important aspect of the relation between smoking and trauma in need of further study is the explication of motivations for smoking among daily smokers who have been exposed to traumatic events. Numerous researchers have theorized that persons who respond symptomatically to trauma exposure may smoke to regulate negative affect to a greater extent than those without such reactions (Acierno et al., 1996; Beckham, 1999; Beckham et al., 1995; Weaver & Etzel, 2003). Additionally, relative to other motivations for smoking, such as relaxation or addictive motives, negative affect reduction motives may be more likely among individuals with trauma symptomatology. Although the anxiety-ameliorating effects are complex and not completely understood (Kalman, 2002), most smokers believe smoking will alleviate negative affective states (Brandon, 1994; Parrott, 1999; Pomerleau & Pomerleau, 1991). Building from such work, some have suggested that, in the absence of other more adaptive coping strategies, smokers who respond symptomatically to trauma may learn to rely on smoking to manage anxiety and other negative mood states (Acierno et al., 1996). This perspective is consistent with other smoking-anxiety work that has shown individuals with pre-morbid panic vulnerability factors (e.g., anxiety sensitivity) or clinically significant panic problems (e.g., panic disorder) tend to smoke to attempt to terminate or avoid nicotine withdrawal or related aversive states such as anxiety (Zvolensky & Bernstein, 2005; Zvolensky et al., 2006, 2005). Indirect evidence, albeit limited, supports this model. First, smoking is associated with greater posttraumatic stress symptomatology (Beckham et al., 1995; Schnurr & Spiro, 1999) and trauma-exposed individuals with, versus without, associated psychopathology are significantly more likely to be current smokers (Acierno et al., 1996), begin smoking (Breslau, Davis, & Schultz, 2003), smoke at higher rates (Beckham et al., 1997), and evidence greater puff volumes (which maximize smoke delivery) while smoking (McClernon et al., 2005). Second, anxiety-inducing situations increase smoking cravings among smokers with trauma-related psychopathology (Beckham et al., 1996). Finally, smokers who fear anxiety-related sensations, such as those with posttraumatic stress disorder (PTSD; Lang, Kennedy, & Stein, 2002; Taylor, Koch, & McNally, 1992), expect tobacco use to help alleviate aversive anxiety states (Zvolensky et al., 2004) and these individuals often principally smoke to regulate affect (Zvolensky et al., 2006).

Despite recognition that smoking to reduce negative affect may be integral to understanding the smoking–trauma relation, there have been relatively few direct tests of the model. In one study (Beckham et al., 1995), a sample of 124 daily smoking male Vietnam veterans seeking help for PTSD was examined. Here, several variables, including marital status, race, combat exposure, state and trait anxiety, PTSD symptomatology, and depressive symptoms, were entered as predictors into a stepwise regression model predicting six different motives for smoking (i.e., stimulation, indulgent, psychosocial, sensorimotor, addictive, and automatic) on an abbreviated version of the Motives for Smoking Scale (Russell, Peto, & Patel, 1974). Additionally, an identical regression model was utilized to predict negative affect reduction motives, which were indexed via two (of the six) items that measure such motives on the Reasons for Smoking questionnaire (Ikard, Green, & Horn, 1969) and one item from the Motives for Smoking Scale. Depressive symptoms emerged as the only significant predictor of automatic smoking motives and there

were no other significant predictors for other smoking motives. To the best of our knowledge, only one other study tested the relation between PTSD (presence versus absence) and motives for smoking, wherein 445 help-seeking Vietnam combat-exposed veterans were studied (Beckham et al., 1997). The researchers, again, utilized an abbreviated version of the Motives for Smoking Scale, and results were reported for six subscales: stimulation, indulgent, tension reduction, addictive, automatic, and psychosocial. After statistically controlling for age, socioeconomic status, and combat exposure, the presence of PTSD predicted greater indulgent, addictive, automatic, and tension reduction motives for smoking. Smoking status [heavy ($\geq$25 cigarettes per day) versus light-moderate ($<$25 cigarettes per day)], which significantly predicted all smoking motives except for indulgence, did not moderate the association between PTSD and smoking motives despite persons with PTSD being more likely to be heavy smokers.

There are a number of key limitations to extant research pertaining to smoking motivation among trauma-relevant samples. First, negative affect reduction motives for smoking are of central interest to theory explaining why people who respond to trauma symptomatically evidence high smoking levels, yet the validity of negative affect reduction measures used to date is unclear. Specifically, the scale indexing smoking to reduce negative affect utilized by Beckham et al. (1995, 1997) was comprised of items from two separate measures and little psychometric data were reported. Second, prior studies have not controlled for number of cigarettes smoked per day, which is unfortunate, as smoking levels relate to smoking motivations (Beckham et al., 1997; Zvolensky et al., 2006). Controlling for number of cigarettes smoked per day would be an important contribution to this literature, as its inclusion would increase confidence that associations between posttraumatic stress symptomatology and smoking motivations are due to trauma-related psychopathology, and not differing smoking levels between those with, versus without, posttraumatic stress psychopathology. Third, the stepwise regression approach utilized by Beckham et al. (1995) may have underestimated the relation between trauma-related symptomatology and motives for smoking. Specifically, statistically controlling for variance accounted for by depressive symptoms in these analyses may be problematic because of the high degree of overlap between depressive and posttraumatic stress symptomatology (see Acierno et al., 2000). And finally, it is noteworthy that prior studies have focused on persons suffering from combat-related chronic and severe PTSD. The degree to which the findings from these studies generalize to trauma-exposed persons more generally is not clear. Instead, these findings may be specific to factors that relate to long-term maintenance of PTSD among this chronic subgroup.

The present study sought to address these limitations by examining the relations between posttraumatic stress symptomatology and smoking motives among trauma-exposed young adults. The current study sampled younger adults than those studied in previous research (M_{ages}=45 and 47 years; Beckham et al., 1995, 1997), which was advantageous for two reasons: (1) this represents a novel extension to prior research on trauma and smoking motives and (2) smoking generally peaks among young adults between the ages of 18 and 25, and smoking prevalence among this age group has risen in recent years (Presley, Meilman, & Leichliter, 2002; Wechsler, Rigotti, Gledhile-Hoyt, & Lee, 1998). The primary hypothesis tested was that greater levels of posttraumatic stress symptoms would predict greater negative affect reduction smoking motives above and beyond number of cigarettes smoked per day and gender, both of which relate to smoking motives (Beckham et al., 1997; Ikard et al., 1969; Zvolensky et al., 2006). For instance, in a national probability sample of 2094 smokers, habitual, addictive, and negative affect reduction motives demonstrated moderate-sized correlations with daily smoking levels among both males (r's 0.27–0.41) and females (r's 0.40–0.53); also, males endorsed significantly higher levels of habitual and addictive motives than females and females endorsed higher levels of smoking to

reduce negative affect than males (Ikard et al., 1969). Similarly, among 151 young adult daily smokers, women were significantly more likely to smoke to reduce negative affect than males (Zvolensky et al., 2006). This hypothesis was driven by conceptual models and empirical work suggesting that anxiety risk factors and symptoms are related to greater motivations to smoke to cope with negative affect states (Zvolensky & Bernstein, 2005). It also was expected that posttraumatic stress symptom levels would relate to habitual and addictive smoking motives, but it was not expected that this relation would be observed above and beyond cigarettes smoked per day and gender, as smoking level was expected to account for this relation. Finally, consistent with previous research, we did not expect posttraumatic stress symptoms would relate to relaxation or sensorimotor manipulation motives for smoking.

2. Method

2.1. Participants

The sample consisted of 100 (49 females) daily cigarette smokers who reported exposure to at least one traumatic event. The sample ranged in age from 18 to 61 (M=24.52; S.D.=9.95) years, which can be contrasted to the mean participant ages of 45 (S.D.=2.9; Beckham et al., 1995) and 47 (S.D.=4.3; Beckham et al., 1997) years in previous investigations of the relation between smoking motives and PTSD symptoms. Participants were screened from a larger sample of participants (n=627) recruited via announcements in university classes and flyers placed throughout Northeastern and Appalachian communities. Inclusionary criteria included (1) smoking at least five cigarettes per day and (2) reporting exposure to at least one *Diagnostic and Statistical Manual of Mental Disorders–Fourth Edition Text Revision* (DSM-IV-TR; American Psychiatric Association [APA], 2000) defined traumatic event (i.e., met Criterion A; see below for details). In terms of highest education level completed, 3% endorsed elementary, 6% high school, 80% partial college, and 3% college-level educations and the remaining 8% did not specify. In terms of marital status, 5% were married, 2% were either separated or divorced, 86% were single, and the remaining 7% did not specify. In regard to race/ethnicity, 96% of participants self-identified as Caucasian, 1% African American, 1% Asian-American, and 1% as other.

2.2. Measures

2.2.1. Posttraumatic Diagnostic Scale (PDS)

The PDS (Foa, 1995) is a 49-item self-report instrument designed to assess the presence of posttraumatic stress symptomatology, based on criteria outlined in the DSM-IV (APA, 1994). The PDS is a measure of trauma-related responding that has been recommended for use in research settings due to its good convergence with the gold standard Clinician-Administered Posttraumatic Stress Disorder Scale (CAPS; Griffin, Uhlmansiek, Resick, & Mechanic, 2004) as well as its generally excellent psychometric properties (Foa, Cashman, Jaycox, & Perry, 1997). Respondents report if they have experienced any of 12 traumatic events including an "other" category and then indicate which event was most distressing. Participants then rate if they experienced (1) threat to self or others and (2) helplessness or terror during the most distressing event, and they rate on a Likert type scale ranging from 1 ("less than 1 month") to 6 ("more than 5 years"), how long ago the event occurred. In the present study, consistent with DSM-IV-TR (APA, 2000), a traumatic event was defined as exposure to 1 of the 12 events listed along with

endorsement of both perceived threat and helplessness or terror. Respondents also rate the frequency (0="not at all or only one time" to 3="five or more times a week/almost always") of 17 PTSD symptoms experienced in the past month in relation to the most-disturbing event endorsed (total score range of 0 to 51). Individual items load on several subscales: (a) re-experiencing the event, (b) avoidance of cues associated with the event, and (c) arousal. The PDS can be utilized as a dichotomous (i.e., PTSD-positive versus PTSD-negative) or continuous measure of symptomatology. Consistent with recommendations (Foa et al., 1997) and prior studies using the PDS (Bernstein, Zvolensky, Feldner, Lewis, & Leen-Feldner, 2005; Feldner, Lewis, Leen-Feldner, Schnurr, &, Zvolensky, in press), a sum of frequency ratings of each symptom was calculated to index total PTSD symptom levels. This score was utilized as a continuous index of posttraumatic stress symptom levels with higher scores suggesting more severe symptomatology. The PDS was also used to index symptom levels within each symptom cluster as defined by the DSM-IV-TR (clusters B through D correspond to reexperiencing, avoidance, and arousal symptoms, respectively). Finally, the PDS was used to index likely diagnoses of PTSD in the past-month as described by Foa (1995); a positive diagnosis was defined as meeting criteria A through F as outlined in the DSM-IV-TR (APA, 2000).

2.2.2. Reasons for Smoking (RFS)

The RFS (Ikard et al., 1969) was used to assess different motives for smoking. The psychometric properties of this scale, including measures of factor structure, internal consistency, and test–retest reliability, are well-established (Shiffman, 1993), and it has successfully been employed in prior studies of the relation between anxiety and smoking motives (Zvolensky et al., 2006). The RFS consists of 23 items, which comprise 6 subscales: Habitual (e.g., "I've found a cigarette in my mouth and didn't remember putting it there;" range: 4–20), Addictive (e.g., "Between cigarettes, I get a craving only a cigarette can satisfy;" range: 5–25), Negative Affect Reduction (e.g., "When I feel uncomfortable or upset about something, I light up a cigarette;" range: 6–30), Relaxation (e.g., "I find cigarettes pleasurable;" range: 2–10), Sensorimotor (e.g., "Part of the enjoyment of smoking a cigarette comes from the steps I take to light up;" range: 3–15), and Stimulation (e.g., "I like smoking when I am busy and working hard;" range: 3–15). Items are rated on a 1 ("never") to 5 ("always") Likert-type scale. Recent work using the 23-item RFS suggests that each of the subscales demonstrated adequate internal consistency and convergent as well as discriminant validity (Zvolensky et al., 2005, 2006).

2.3. Procedure

Participants were asked to meet with a research assistant individually for one laboratory session. Upon their arrival, each participant was informed of the purpose and goals of the present study. Written informed consent was then obtained. Participants anonymously completed a battery of assessment instruments. Upon completion of the questionnaires, participants were debriefed as to the purpose of the research and compensated with either extra credit or $30.

2.4. Data analytic approach

Hypotheses were tested using a hierarchical multiple regression procedure (Cohen & Cohen, 1983). For all models, number of cigarettes smoked per day and gender (coded dichotomously; 1=male, 2=female) were entered simultaneously at level 1 and posttraumatic stress symptom level was entered at

level 2. These models allow for testing the incremental (or relative) validity of posttraumatic stress symptomatology above and beyond factors entered at level 1 (Sechrest, 1963). Consistent with previous examinations of the relation between anxiety-relevant constructs and smoking motives (Zvolensky et al., 2006), indices of manifest anxiety (e.g., trait anxiety) and negative affectivity were not entered as covariates in the model on an a priori basis. The decision is based on the fact that negative emotional symptoms are a fundamental aspect of the primary predictor of interest (posttraumatic stress symptom levels; Watson, 2005) as well as the criterion variables. Therefore, there is no conceptual rationale to covary such variance. That is, removing variance accounted for by manifest negative affect symptoms from the primary predictor of interest would omit a central, defining feature of the construct, obstructing a test of the study hypotheses (see Miller and Chapman, 2001 for a discussion).[1]

We also conducted two series of secondary analyses to further refine understanding of how smoking motives relate to symptomatic responding to trauma. First, where posttraumatic symptom levels were significantly related to a given smoking motive, hierarchical regression analyses, generally structured as those described above were conducted to examine the relation between symptom levels within specific symptom clusters (i.e., reexperiencing, avoidance, arousal) and that smoking motive. Second, analyses of variance (ANOVAs) were conducted to compare those who met criteria for PTSD with those who did not in terms of smoking motives. In contrast to the regression analyses described above, gender and daily cigarette smoking levels were not included as covariates in these ANOVAs because both of these factors significantly differed between groups and including factors that are systematically related to grouping variables as covariates in between group comparisons is problematic (Miller & Chapman, 2001). Specifically, a greater percentage of women (23%) than men (14%) met diagnostic criteria for PTSD (Pearson chi square = 4.03, $p < 0.05$) and those who met diagnostic criteria endorsed significantly ($t = 8.64$, $p < 0.01$) higher daily smoking levels (M = 18.07, S.D. = 7.68) than those who did not meet criteria (M = 13.93, S.D. = 5.75).

3. Results

3.1. Descriptive data and zero-order correlations

First, in terms of descriptive information regarding smoking characteristics, on average participants were smoking 16.18 (S.D. = 7.04) cigarettes per day, began smoking at age 15.58 (S.D. = 2.54), and reported regularly smoking for an average of 10.14 (S.D. = 11.96) years. Mean scores on the subscales of the RFS (Ikard et al., 1969) were as follows: 19.79 (S.D. = 5.49) for negative affect reduction; 7.03 (S.D. = 2.59) for stimulation; 8.37 (S.D. = 2.92) for habitual reasons; 15.33 (S.D. = 4.12) for addictive reasons; 7.47 (S.D. = 2.10) for relaxation; and 7.14 (S.D. = 3.29) for sensorimotor manipulation.

In regards to trauma symptom-related descriptive information, there was an average symptom severity score on the PDS (Foa, 1995) of 12.00 (S.D. = 11.36), with a range of 0% to 39% and 37% of participants meeting criteria for PTSD. By way of comparison, 9.2% of a representative community-

[1] We also tested the interaction between posttraumatic stress symptom levels and (1) gender and (2) cigarettes smoked per day, to determine whether the association between symptom levels and smoking to reduce negative affect varied as a function of these factors. Specifically, the incremental predictive validity of the interaction between gender (or cigarettes per day) and posttraumatic stress symptom levels above and beyond the main effects of each was tested and there were no significant interactions ($\Delta R^2 = 0.00$ for each).

based sample of trauma-exposed persons met criteria for PTSD (Breslau et al., 1998). It is important to note, however, the PDS may over-diagnose PTSD relative to a structure clinical interview (Griffin et al., 2004) and the prevalence of PTSD among trauma-exposed smokers may be expected to be higher than in the general community due to the high comorbidity rates between smoking and PTSD (Beckham, 1999; Lasser et al., 2000). Traumatic events most frequently reported included natural disaster ($n=43$), serious accident, fire, or explosion ($n=63$), non-sexual assault by a family member or someone known ($n=28$), non-sexual assault by a stranger ($n=28$), sexual assault by a family member or someone known ($n=17$), sexual assault by a stranger ($n=11$), military combat ($n=6$), sexual contact by someone more than 5 years older when the participant was younger than 18 years old ($n=25$), imprisonment ($n=14$), torture ($n=4$), life-threatening illness ($n=27$) and other ($n=35$). In terms of duration since trauma exposure, 42% reported their most distressing event occurred at least 5 years ago, 20% reported the event occurred between 3 and 5 years ago, 27% indicated the event occurred between 6 months and 3 years ago, and the remaining 10% indicated the event occurred within the last 6 months. In terms of number of traumatic events reported, 22% reported 1, 30% reported 2, 20% reported 3, 8% reported 4, and the remaining 20% reported more than 4.

Table 1 contains the zero-order correlations among the variables examined. As predicted, posttraumatic stress symptomatology was significantly associated with negative affect reduction ($r=0.32$, $p=0.01$), habitual ($r=0.21$, $p=0.05$), and addictive ($r=0.21$, $p=0.05$) smoking motives and nonsignificantly associated with relaxation ($r=0.10$, $p>0.1$) and sensorimotor manipulation ($r=-0.02$, $p>0.1$) motives. In contrast to expectation, posttraumatic stress symptomatology was significantly associated with stimulation motives ($r=0.24$, $p<0.01$). Only level of negative affect reduction motives significantly differed ($t=8.5$, $p<0.01$) between males (M=18.31, S.D.=5.56) and females (M=21.28, S.D.=5.02).

3.2. Primary analyses

Table 2 provides a synopsis of the main hierarchical regression analyses. First, at level 1 greater cigarettes smoked per day ($\beta=0.30$, $sr^2=0.09$) and being female ($\beta=0.31$, $sr^2=0.09$) significantly predicted greater negative affect reduction motives. Consist with hypotheses, at level 2 greater levels of posttraumatic stress symptoms, after controlling for factors at level 1, significantly predicted higher

Table 1
Correlations among posttraumatic stress symptomatology, cigarette smoking levels, and smoking motives

	1	2	3	4	5	6	7	8
1. Posttraumatic Stress Symptomatology (PDS)	–	0.21*	0.32**	0.24**	0.21*	0.21*	0.10	−0.02
2. Cigarettes per day	–	–	0.27**	0.10	0.29**	0.33**	0.09	−0.19*
3. Negative affect reduction (RFS)	–	–	–	0.48**	0.52**	0.63**	0.34**	0.13
4. Stimulation (RFS)	–	–	–	–	0.36**	0.45**	0.51**	0.36**
5. Habitual reasons (RFS)	–	–	–	–	–	0.50**	0.10	0.05
6. Addictive reasons (RFS)	–	–	–	–	–	–	0.26**	0.15
7. Relaxation (RFS)	–	–	–	–	–	–	–	0.46**
8. Sensorimotor manipulation (RFS)	–	–	–	–	–	–	–	–

$N=100$. PDS: Posttraumatic Diagnostic Scale (Foa, 1995); RFS: Reasons for Smoking questionnaire (Ikard et al., 1969).
* $p<.05$.
** $p<.01$.

Table 2
Contributions of gender, cigarette smoking levels, and posttraumatic stress symptomatology in predicting smoking motives

	ΔR^2	t (each predictor)	β	sr^2	p
Dependent variable: smoking to reduce negative affect					
Step 1	0.17				<0.001
Daily cigarettes		3.26	0.30	0.09	<0.01
Gender		3.45	0.31	0.09	<0.01
Step 2	0.03				<0.05
Daily cigarettes		2.72	0.25	0.05	<0.01
Gender		2.89	0.27	0.06	<0.01
PTSD symptom severity		2.19	0.20	0.03	<0.05
Dependent variable: smoking for habitual reasons					
Step 1	0.09				<0.001
Daily cigarettes		3.09	0.30	0.09	<0.01
Gender		0.70	0.06	0.00	ns
Step 2	0.02				ns
Daily cigarettes		2.68	0.26	0.09	<0.01
Gender		0.33	0.03	0.00	ns
PTSD symptom severity		1.49	0.15	0.02	ns
Dependent variable: smoking for addictive reasons					
Step 1	0.16				<0.001
Daily cigarettes		3.78	0.35	0.12	<0.001
Gender		2.47	0.23	0.04	<0.05
Step 2	0.00				ns
Daily cigarettes		3.43	0.32	0.09	<0.01
Gender		2.15	0.20	0.04	<0.05
PTSD symptom severity		1.04	0.10	0.00	ns
Dependent variable: smoking for stimulation					
Step 1	0.01				ns
Daily cigarettes		1.07	0.10	0.09	ns
Gender		0.65	0.06	0.00	ns
Step 2	0.04				<0.05
Daily cigarettes		0.56	0.05	0.09	ns
Gender		0.12	0.01	0.00	ns
PTSD symptom severity		2.16	0.22	0.02	<0.05
Dependent variable: smoking for sensory motor manipulation					
Step 1	0.05				ns
Daily cigarettes		−2.09	−0.20	0.04	<0.05
Gender		−1.25	−0.12	0.01	ns
Step 2	0.00				ns
Daily cigarettes		−2.14	−0.21	0.04	<0.05
Gender		−1.32	−0.13	0.01	ns
PTSD symptom severity		0.48	0.05	0.00	ns

(*continued on next page*)

Table 2 (*continued*)

	ΔR^2	*t* (each predictor)	β	sr^2	*p*
Dependent variable: smoking to relax					
Step 1	0.01				ns
Daily cigarettes		0.86	0.08	0.00	ns
Gender		−0.69	−0.07	0.00	ns
Step 2	0.01				ns
Daily cigarettes		0.59	0.06	0.00	ns
Gender		−0.94	−0.09	0.00	ns
PTSD symptom severity		1.09	0.11	0.01	ns

$N=100$. β = standardized beta weight; sr^2 = squared semi-partial correlation.

levels of smoking to reduce negative affect ($\beta=0.20$, $sr^2=0.03$). Results regarding smoking for habitual and addictive motives also were consistent with hypotheses. Higher levels of cigarettes smoked per day was the only significant predictor of greater smoking for habitual motives ($\beta=0.30$, $sr^2=0.09$). Posttraumatic stress symptom level was not a significant predictor beyond cigarettes smoked per day. The pattern of results was similar for addictive smoking motives; greater number of cigarettes smoked per day ($\beta=0.35$, $sr^2=0.12$) and being female ($\beta=0.23$, $sr^2=0.04$) significantly predicted higher levels of addictive motives. Again, posttraumatic stress symptom levels did not significantly predict beyond these factors. In contrast to expectation, posttraumatic stress symptoms significantly predicted smoking for stimulation. Neither cigarettes smoked per day nor gender predicted smoking for stimulation, but greater posttraumatic stress symptom levels predicted greater smoking for stimulation ($\beta=0.22$, $sr^2=0.02$). In terms of smoking for sensory motor manipulation, only cigarettes smoked per day ($\beta=-0.20$, $sr^2=0.04$) emerged as a significant predictor, with higher levels predicting lower levels of sensory motor manipulation motives. There were no significant predictors of smoking to relax.

3.3. Secondary analyses

First, in terms of levels of posttraumatic symptoms within individual symptom clusters predicting negative affect reduction motives, variance accounted for at level 1 of the model was comparable to the analysis reported in Table 2 corresponding to this criterion variable. At level 2, only higher levels of avoidance ($t=2.41$, $\beta=0.22$, $p<0.05$, $sr^2=0.04$) and arousal ($t=2.12$, $\beta=0.19$, $p<0.05$, $sr^2=0.03$) symptoms were significantly related to higher levels of smoking to reduce negative affect. In terms of smoking for stimulation, see Table 2 for the pattern of results at level 1 of the model. At level 2, only higher levels of avoidance symptoms were significantly related to higher levels of smoking for stimulation ($t=2.18$, $\beta=0.22$, $p<0.05$, $sr^2=0.04$), although there also were trends toward significant positive relations with both the reexperiencing ($p=0.057$) and arousal ($p=0.077$) symptom clusters. Second, ANOVAs revealed that persons meeting, versus not meeting, criteria for PTSD were significantly more likely to smoke to reduce negative affect [$t=6.22$, $p<0.05$; M = 21.59 (S.D. = 5.89) and M = 18.77 (S.D. = 4.83), respectively], for habitual reasons [$t=4.20$, $p<0.05$; M = 9.24 (S.D. = 3.45) and M = 7.94 (S.D. = 2.58), respectively], and for addictive reasons [$t=7.59$, $p<0.01$; M = 16.74 (S.D. = 4.09) and M = 14.33 (S.D. = 4.09), respectively]. Groups did not significantly differ in terms of levels of other smoking motives.

4. Discussion

Consistent with prediction, greater posttraumatic stress symptom levels predicted greater smoking to reduce negative affect. Moreover, this relation was observed above-and-beyond variance accounted for by the theoretically relevant factors of gender and cigarettes smoked per day, both of which have been linked to smoking to reduce negative affect (Ikard et al., 1969; Wetter et al., 1999; Zvolensky et al., 2006). That is, trauma-exposed individuals with higher levels of posttraumatic stress symptoms are more likely to report smoking to reduce negative affect, regardless of smoking level or gender. Secondary analyses further suggested that those meeting criteria for PTSD smoke more to reduce negative affect than those who do not meet criteria, and trauma-related avoidance and arousal symptoms, but not reexperiencing symptoms, were related to smoking to reduce negative affect. These data are consistent with suggestions that smokers who respond symptomatically to trauma may utilize smoking to manage anxiety and other negative mood states in the relatively short-term (Acierno et al., 2000). They also suggest that examining the function of smoking in terms of managing hyperarousal, perhaps via the termination of nicotine withdrawal, may more specifically delineate the nature of the trauma symptom – smoking to reduce negative affect association. Similarly, the finding that avoidance symptoms are related to smoking to reduce negative affect highlights the need to more fully explore the types of avoidance that persons who respond symptomatically to trauma exposure may utilize. For instance, future research on the reliance of smoking as a coping strategy, relative to other strategies, would be informative as smokers with posttraumatic stress problems may be in particular need of learning adaptive strategies for coping with trauma-related negative affect. Indeed, long-term smoking likely will increase negative affect via a number of routes, including nicotine-based withdrawal symptoms, health impairment, and physical illness. Future research using prospective designs would be helpful in teasing apart these issues and setting the stage for a more refined understanding of the affect regulatory functions of smoking among those exposed to trauma.

In contrast to expectation, higher levels of posttraumatic stress symptoms also predicted more frequent self-reported smoking for stimulation, with secondary analyses suggesting that stimulation motives were significantly related to avoidance symptoms. This finding is in contrast to previous investigations of the relation between smoking motives and PTSD (Beckham et al., 1995, 1997), and may be due to differences between samples. For instance, our sample was younger than those studied previously (M_{age}=24 versus 45 and 47 years); it may be that youth are more likely to smoke for stimulation when managing posttraumatic stress symptoms. Alternatively, it may be that Vietnam veterans, who likely are more nicotine dependent than the current sample as suggested by higher levels of daily cigarette use (28 versus 16 cigarettes per day, respectively), experience less stimulation in response to smoking, and therefore are less motivated to smoke for stimulation regardless of posttraumatic symptom level. Another possible explanation relates to the high degree of variability in posttraumatic symptoms in this sample relative to those studied previously. It may be the constrained variance in posttraumatic stress symptom levels observed within samples of Vietnam veterans precluded observation of a relation between such symptomatology and smoking for stimulation. These possible explanations are not mutually exclusive and, as this finding was in contrast to theoretical prediction, replication and additional empirical investigation is needed prior to drawing conclusions.

Consistent with expectation, posttraumatic stress symptom levels did not predict smoking for addictive or habitual reasons above and beyond gender and cigarettes smoked per day. While

comparisons to previous studies are made difficult by the use of different indices of smoking motivations, these data extend previous findings. Specifically, associations between the presence of PTSD and greater automatic and addictive smoking motives (Beckham et al., 1997) may be accounted for by higher smoking levels among individuals with PTSD, rather than suggestive of posttraumatic symptom levels per se affecting these motivations. Indeed, number of cigarettes smoked per day significantly predicted habitual and addictive smoking motives and secondary analyses suggested those meeting criteria for PTSD in the current sample reported higher levels of smoking for habitual and addictive reasons when daily cigarette levels and gender were not included as covariates. Also consonant with expectation, posttraumatic stress symptom levels did not relate to sensorimotor manipulation or relaxation motives for smoking. While highly anxious individuals may seem likely to smoke to relax, our null finding is consistent with previous studies that suggest anxiety-related characteristics are not significantly related to smoking for relaxation (Zvolensky et al., 2006). Examination of the items that comprise the relaxation subscale (i.e., "Smoking cigarettes is pleasant and relaxing" and "I find cigarettes pleasurable") suggests that perhaps, because anxious individuals often report poorer perceived health (Schmidt, Joiner, Staab, & Williams, 2003; Yartz, Zvolensky, Gregor, Feldner, & Leen-Feldner, 2005), persons with higher levels of trauma-related symptoms do not find smoking to be "pleasant" or "pleasurable" due to concerns about the negative health effects of smoking.

Limitations of the current study need to be considered. First, comparisons between those who did, versus did not, meet criteria for PTSD need to be interpreted with caution. While the PDS (Foa, 1995) demonstrates excellent psychometric properties (Foa et al., 1997) and has been recommended for use in a research context (Griffin et al., 2004), it is prone to over diagnosis of PTSD compared to the CAPS (Griffin et al., 2004). Thus, the differences between those with, versus without, PTSD observed in the current study should be viewed as tentative until they are replicated using the CAPS (Blake et al., 1995). Second, this study relied exclusively on self-report methodology. Utilizing multimodal assessment in a laboratory-based context, wherein experimental tests of the effects of manipulating affective state on smoking behavior as a function of posttraumatic stress symptomatology could be conducted, would increase confidence that smoking to reduce negative affect is a mechanism underlying the PTSD–smoking association. Third, a cross-sectional methodology was utilized. While this strategy was useful in establishing relations between smoking motives and posttraumatic stress symptomatology at this early stage in this research program, it does not permit inferences regarding the role of either factor in the development or maintenance of the other. Although 42% of the sample reported trauma exposure occurring at least 5 years ago, they also reported beginning smoking approximately 10 years ago. Thus, these data are limited in their ability to speak to issues of time course in symptomatic responding to trauma and smoking comorbidity. Utilization of longitudinal designs in future studies will be important to tease apart such issues. Fourth, the young adult sample studied consisted of relatively light smokers, which leaves open the possibility that the current findings differed from the work of Beckham et al. (1995, 1997) due to differences in smoking levels between the samples. Although variance accounted for by cigarettes smoked per day was statistically controlled (and there was no interaction between posttraumatic stress symptoms and cigarettes smoked per day), it remains possible that the relation between posttraumatic stress symptom levels and smoking motives differs between heavy versus light smokers. It will be important for future work to extend these findings to heavier young adult smokers, as persons with PTSD tend to smoke heavily (Breslau et al., 2003). Similarly, while studying a sample characterized by a relatively wide distribution of posttraumatic stress symptom levels was advantageous at this stage, it is difficult to ascertain how the current findings would generalize to a sample of persons

diagnosed with PTSD. With the full distribution of symptom levels in the current study, negative affect reduction motives appear positively associated with such symptoms. However, prior research (Beckham et al., 1995, 1997) has suggested at high (i.e., clinical) levels of posttraumatic symptoms, these two factors may not be related. Therefore, future tests with sufficient methodological power could examine how a priori-defined specific incremental increases in severity of posttraumatic symptom levels relate to smoking motives to better understand if there is a degree of posttraumatic severity at which persons do not endorse smoking to reduce negative affect. Fifth, the sample was relatively homogenous in terms of ethnicity. Thus, the degree to which these findings generalize to other cultural and ethnic groups remains unclear and future research should include more diverse samples. Finally, we utilized the RFS to assess smoking motives in the present investigation. The RFS has a long standing history in smoking research, but has not always performed adequately as an instrument in terms of its psychometric properties across each subscale (Shiffman, 1993). The advantage of using the RFS in the current investigation was to facilitate comparability to past studies, a useful step at this developmental stage of inquiry in regard to trauma-smoking research. Nonetheless, future studies may benefit by including alternative smoking motives measures and evaluating convergence in pattern of results across investigations.

Together, there was a relatively high degree of specificity wherein posttraumatic stress symptomatology appears particularly related to smoking to reduce negative affect and smoking for stimulation. Further understanding this relation may be critical in developing specialized smoking cessation interventions for persons with trauma-related symptomatology, which may need to include a specific focus on substituting alternative affect regulation strategies for smoking.

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